United States Department of Agriculture

Animal and Plant Health Inspection Service

EMERGENCY PROGRAMS ALERT

Bovine Spongiform Encephalopathy

JULY 1992

UPDATE

APHIS—Protecting American Agriculture

EMERGENCY PROGRAMS ALERT

BOVINE SPONGIFORM ENCEPHALOPATHY (BSE)
July 1992

(Common Names: Raging Cow Disease, Mad Cow Disease)

1. Definition. An afebrile neurological disease of adult cattle, characterized by gradual onset of abnormal motor nerve control, abnormal posture, development of apprehensive behavior and heightened sensory perception, progressive course lasting from 2 weeks to 14 months, decreased milk production in lactating cows, loss of body weight despite continued appetite, and death.

2. Cause. Unknown. However, electron microscopy has shown insoluble strands of protein in BSE-affected brain similar to the scrapie-associated fibrils (SAF) that are found in all species affected by scrapie and certain related diseases that have been attributed to infectious agents called "prions." The finding of BSE fibrils, together with clinical signs and histopathological lesions of scrapie in mice injected with BSE brain suggests that BSE and scrapie may be caused by a similar agent.

3. Background. In retrospect, clinical BSE was first seen in April 1985, and was first diagnosed in the laboratory during November 1986. There were 149 cases of BSE in 1987[1]; then 1,910 cases in 1988[1], when BSE was declared a reportable disease in Great Britain; and 61,030 confirmed cases by July 19, 1992 (10 million cattle are in Great Britain, 4 million of which are adults). First exposures to the BSE agent were estimated to have occurred in 1981. The disease was also reported from Ireland in 1989, Oman in 1990[2], Falklands, Switzerland, and France in 1991. Attempts to transmit scrapie to cattle were conducted by the U.S. Department of Agriculture at Mission, Texas, beginning in January 1979. Three of 10 experimentally inoculated cattle developed progressive neurological clnical signs 27, 36, and 48 months later, and were sacrificed at the 43rd, 44th, and 73rd day after the onset of neurological abnormalities. Histological studies did not confirm the clinical diagnosis of scrapie. However, tissues from these animals were recently re-examined and shown to contain the abnormal isoform of prion protein.

4. Disease Characteristics. Although both dairy and beef breeds of cattle are affected, most cases have been in the Holstein-Friesian breed. Mice inoculated with BSE brain develop neurological signs of scrapie 300 to 450 days later. The incubation period in cattle has been estimated to be from 2 to 8 years. Age of affected cattle at onset ranged from 1 year 10 months to 15 years. The disease course varies from less than 2 weeks to 14 months, with most of the affected animals dying or requiring humane destruction within 4 months of onset.

The majority of cases include behavioral disorders, gait and postural abnormalities, and loss of body weight. The history usually begins with altered behavior, including apprehension, anxiety, and fear. Some cows may paw the ground or frequently lick their nostrils. Commonly, there is increased reaction to stimuli, such as sound and touch. Some animals become aggressive. A swaying gait, sometimes with high stepping, may occur. Kicking is also common. Progressive deterioration occurs with reduced milk yield, loss of condition, weakness, and falling.

Although the means of transmission is unknown, the feeding of scrapie-contaminated meat and bone meal or other ruminant-derived protein is strongly suspected. No evidence of transmission from cattle to cattle has been found. Neither has there been any evidence of introduction into Great Britain by imported cattle or semen.

5. Epidemiology. BSE is believed to be an extended common-source epidemic with no evidence of cattle-to-cattle transmission, so that each affected animal represents an index case.[3] There is no evidence of introduction through biological products, chemicals, pharmaceuticals, or semen. The disease has not been shown to be hereditary, but there is a possibility that individual animal susceptibility to BSE may be inherited. Exposure risk for calves is estimated 30 times that for adult cattle. The suspected source is scrapie-infected or BSE-infected material in the diet. The 61,030 confirmed cases are dispersed in 18,906 herds in Great Britain. At the present time there are 800 to 1000 new clinical cases reported each week.

6. Diagnosis. Cattle showing clinical signs consistent with BSE should be sampled. Because rabies can cause signs similar to BSE in cattle, tissues collected should also be appropriate for rabies diagnosis. Microscopic examination of specific areas of the brain is necessary to establish a diagnosis.

Cattle suspected of having the disease should be killed with an intravenous injection of an approved barbiturate drug or other appropriate method. The whole brain should then be removed with a portion of the cranial cervical spinal cord attached.

BRAIN REMOVAL

Removal of the brain intact requires a delicate and exacting technique. Several methods are satisfactory and the procedures will probably be varied somewhat by each individual. The objective is to get the brain removed and shipped with as little contamination, distortion, and laceration as possible.

A. Rubber gloves should be worn for protection and appropriate safety glasses should also be worn.

B. Incise the skin on the midline over the poll, forehead and nose. Reflect skin laterally to expose the skull, orbits, and posterior part of the nose. Remove any muscle and fat from the areas to be sawed.

C. With a postmortem saw, cut transversely at the level of the posterior part of each orbit (Figure 1, cut A). This cut should be 1-2 cm in depth.

D. After making the transverse cut, separate the head from the carcass by cutting through the atlanto-occipital joint.

E. Next, cuts are made on each side of the skull from the foramen magnum to a point 2-3 cm medial to the orbital rim transecting the previous cut (Figure 1, cut B). Each cut should be angled inward at about 45° from the vertical axis.

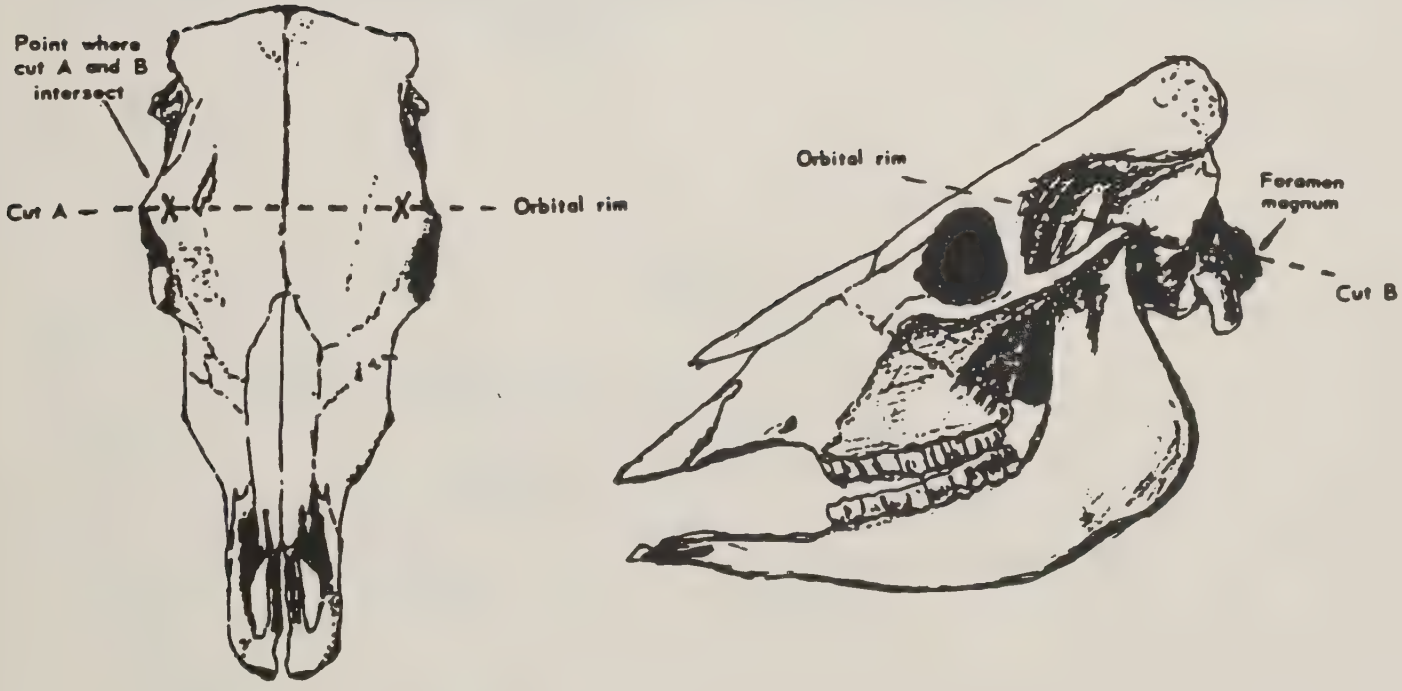

FIGURE 1

F. Insert a heavy knife or bone chisel into the transverse cut and slowly pry the skull cap upward and backward. Precautions should be taken to prevent the attached meninges from compressing or tearing the brain parenchyma. The meninges are cut as the skull cap is removed. Scissors are more suitable than a knife for cutting these membraneous attachments.

G. Cut the meninges between the cerebral hemispheres and over the cerebellum and reflect them laterally to remove them.

H. Hold the head with the nose or jaw pointing upward to allow gravity to assist removal of the brain from the cranial cavity. Cut through the brain attachments beginning with the olfactory tracts, optic nerves, pituitary stalk and working posteriorly through the other cranial nerve roots. Gently tease the brain out of the cranial cavity while cutting through the attachments. Allow the brain to drop gently onto a clean, dry surface.

I. Detach the medulla, pons, cerebellum, and cervical spinal cord from the rostral most portions of brain by making a transverse cut just cranial to the cerebellum and caudal to the caudal colliculus (Fig. 2). The rostral portions of brain, which contain the cerebral hemispheres and the mesencephalon, should then be cut longitudinally in half (Fig. 2) with one half to be placed unfixed in an appropriately labelled plastic specimen container and the other half placed in approximately 1 gallon of 10 percent buffered formalin.

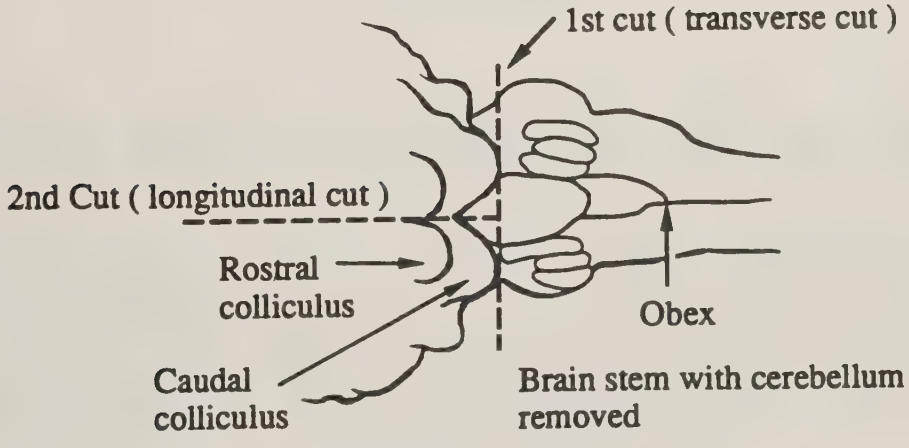

FIGURE 2

J. Remove the lateral one third of cerebellum and the cranial cervical spinal cord and place unfixed in an appropriately labelled plastic specimen container (Fig. 3). The remaining larger portion of brain including the pons, obex area of the medulla, and two thirds of the cerebellum should be placed in the 10 percent buffered formalin.

Diagram of brain: Shaded areas indicate tissues to be frozen or refrigerated.

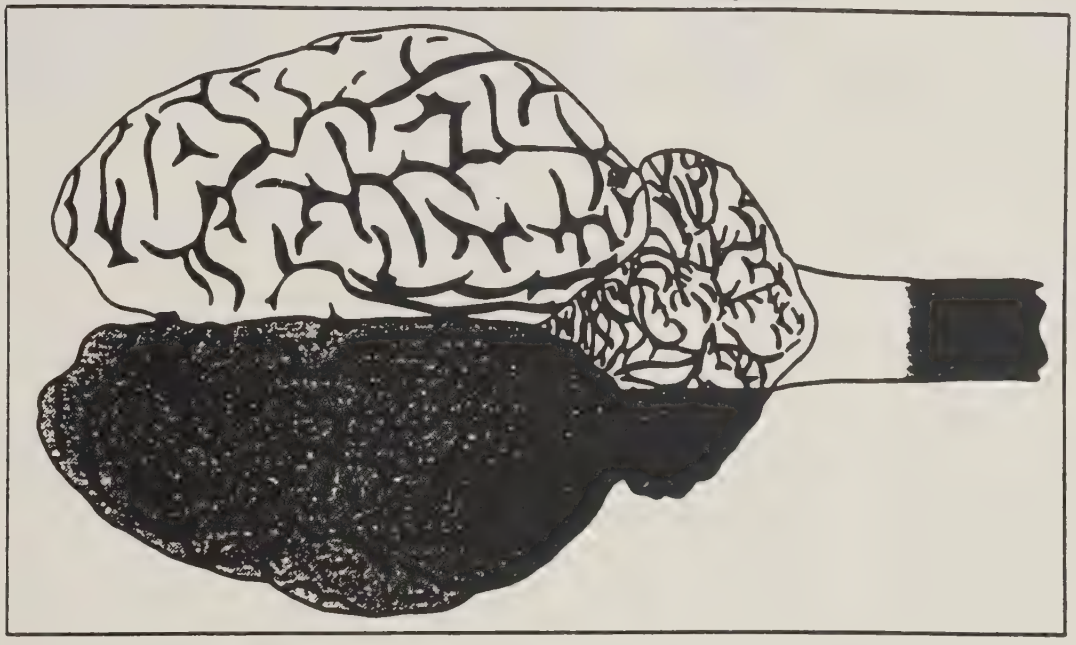

FIGURE 3

Do not freeze formalin-fixed brain. To avoid freezing, fixed brain must be shipped in a separate insulated container.

The unfixed brain tissue can be sealed in a specimen bag and either frozen or, if it will arrive at the laboratory within 36 hours, refrigerated with gel packs. These unfixed specimens can be used for western blot prion protein analysis, animal inoculation studies, rabies testing, or other appropriate diagnostic tests. If rabies indirect fluorescent antibody testing is requested, do not freeze tissues.

7. Control. Beginning in July 1988, Great Britain prohibited the inclusion of ruminant-derived protein, including meat and bone meal, in ruminant feedstuffs. Results of this control measure are not expected until 1992. The United States has prohibited the importation of ruminants from the United Kingdom since July 1989.

8. Reporting. Suspected occurrences of BSE should be immediately reported to Emergency Programs, U.S. Department of Agriculture, at commercial Area Code (301) 436-8092, or to the nearest Federal or State livestock health official.

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1. Minister Outlines Extent of BSE. Vet Rec, Dec. 9, 1989, p. 589.
2. BSE in Oman. Vet Rec, Jan 27, 1990, p 92.
3. Bovine spongiform encephalopathy: recent observations on the age-specific incidences. Vet Rec, May 30, 1992, p 491.